Prepared by the North Dakota Legislative Council staff for the Energy Development and Transmission Committee
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ALLOCATION OF WIND RIGHTS - BACKGROUND MEMORANDUM

House Concurrent Resolution No. 3044 (attached as an appendix) directs the Legislative Management to study the allocation of wind rights. The resolution suggests studying the connection between wind rights and the surface estate, for example, as in oil and gas, which are allocated in relation to the surface rights and not on a first come, first served basis. In addition, the resolution suggests addressing noise and visual disturbances, spacing, and setbacks as part of the fair allocation of wind resources.

The legislative history of the resolution shows that the impetus for the study came from the present uncertainty as to wind rights. This uncertainty could lead to litigation. Litigation raises the risk and cost of development and this could stifle wind development. The reason for the uncertainty comes from the fact that wind turbines have an impact that exceeds the physical tower. Wind turbines affect wind by creating a wind wake. The wind wake extends downwind up to 11 times the turbine rotor diameter. Wind turbines produce a downwind wake that reduces the amount of energy that could be extracted by nearby downwind turbines. Because wind crosses property boundaries, the determination of who has priority rights to the energy in the wind becomes an issue.

ALLOCATION MODELS

One way to address this issue is through setbacks. Setbacks are the distance that wind turbines are placed away from a property line or structure. Setbacks are a limitation on the spacing of wind turbines. Spacing is the placement of wind turbines in the most economical locations for the production of electricity. Spacing balances the cost of construction of the turbine, with the cost of the gathering system, with available wind resources.

Generally, setbacks are at minimum the fall distance of a turbine. If meant to address wind wake, the industry standard for setbacks is five times the diameter of the turbine rotor in the direction of predominate winds and three rotor diameters for spacing in the nonpredominate wind direction. The problem with setback requirements is that the requirements make it difficult to develop wind projects in areas that do not involve extremely large landowners and contiguous holdings. Every property line creates a potential dead zone. In addition, wind towers must be located where the wind speed is highest, which must be based on topography, not property, to be economical.

If setbacks are long enough to mitigate any negative impact on the wind rights of others, allocating wind rights based solely on setbacks makes a 100 percent allocation to the landowner with the turbine. However, these setbacks limit the developer to using property on which the placement of a wind turbine does not have an effect on neighboring property. In this instance, setbacks are not an allocation method because there is nothing to allocate. The setbacks remove the impact of the wind turbine on the wind rights of others. With no impact to allocate, there is no right to allocate. This instance gives priority to the impact and negates the surface property right within the setback.

The legislative history suggests two possible models for the allocation of wind rights. One model is first-in-time, first-in-right and the other is unitization. The first-in-time, first-in-right model is based on how water rights were developed in western states. The unitization model is based on how oilfields are allocated.

Generally, water law in western states allow the first user to develop water from a source and limits subsequent users to using the same source only to the extent the secondary user does not affect the earlier users' ability to use the source. This model could be applied to wind by giving first rights to the energy in the wind within a reasonable distance around the turbine. Subsequent wind users would need to maintain an adequate distance to avoid impacts on the earlier use. These distances can be based on rotor diameters. The advantage of this model is simplicity and the disadvantage is that nearby landowners could be negatively affected without compensation. Allocating wind rights based solely on first-in-time, first-in-right makes a 100 percent allocation to the landowner with the turbine and allows the developer to place the turbine anywhere on the landowner's property, even if the turbine has an effect on neighboring property. This model gives priority to the surface property right and negates any other impact on wind rights of others.

The unitization model is based on the allocation of the production of an oilfield proportionally to the surrounding mineral rights owners, based on a predetermined impact. In the area of oil and gas, "unitization" means the joint operation of all or some part of a producing reservoir. The purpose of unitization is to permit the entire field, or a very substantial portion of it, to be operated as a single entity without regard to surface boundary lines. Both economic and property rights require the integration of a field in order for such operations as gas cycling, pressure maintenance, and secondary recovery to be conducted. Moreover, greater recovery at less cost can be achieved when the field is treated as an entity and wells located so that they maximize the use of reservoir energy. Unitization thus refers to the combination of most, if not all, of the separate tracts in the field into one tract so that the reservoir may be operated without regard to surface property lines. This model could be applied to wind. The allocation of

wind lease payments would be allocated among landowners with an impact by a turbine. Those impacted could include:

- Landowners with a wind resource that is affected.
- Landowners with the surface property that is affected by turbines, roads, and cable easements.
- Landowners affected in other ways, for example, by the changed view, shadows, or sounds.

The advantage of this approach would be to distribute the benefits among a broader base of those affected, which would reduce inequities among landowners affected by the wind turbine. The disadvantage is the complexity and the potential for an unwilling landowner to be part of a project in which the landowner does not wish to participate. The success of this model would be tied to determining the appropriate allocation of payments to the various landowners.

PREVIOUS LEGISLATION AND PRESENT STATUTES

During the 2009 legislative session, a number of bills were introduced relating to wind. Most of these bills related to the taxation of wind-related property. Two bills made substantive changes and directed studies of those changes. House Bill No. 1449 includes a study of the colocation of wind and other natural resources. The bill amended the definition of energy conversion facility for the purpose of Public Service Commission jurisdiction over siting to include any plant designed for or capable of generating in excess of 60 megawatts of electricity. The previous threshold was 100 megawatts or more. House Bill No. 1509 provides for a study of wind easements and wind energy leases. In addition, in relation to wind easements and wind energy leases, Senate Bill No. 2245 changes the time at which a wind option agreement, wind easement, or wind energy lease terminates due to inactivity, from no development within five years, to if within five years of a certificate of a site compatibility or conditional use permit has not been issued if required, and if within five years a transmission interconnection request is in process and not under suspension.

House Bill No. 1426, which failed to pass the House, would have required Public Service Commission approval for the setbacks of five rotor diameters from the perimeter of the site as to prevailing winds and two rotor diameters as to the nonprevailing winds for siting a commercial wind energy conversion facility. A commercial wind energy facility was defined as a wind turbine that exceeds 500 kilowatts. The bill provided for an exemption from the setback requirements based on topography making the standard setback not commercially viable. The bill, as introduced, preempted political subdivision setbacks different from those approved by the commission. The bill was amended to make the setback requirements minimum standards to which political subdivisions could change and make more stringent than state rules.

Current law relating to wind energy conversion siting is contained in North Dakota Century Code (NDCC) Chapter 49-22, which relates to the siting of any energy conversion and transmission facility that meets the criteria of the chapter. Under Section 49-22-03, to be an energy conversion facility, the plant must be designed for or capable of generating 60 megawatts or more of electricity. House Bill No. 1283 (2005) increased the threshold of an energy conversion facility from a facility that generates 50 megawatts or more of electricity to a facility that generates 100 megawatts of electricity. House Bill No. 1449 (2009) decreased the threshold from 100 megawatts to 60 megawatts. Siting that is not within the jurisdiction of the Public Service Commission falls solely within the zoning jurisdiction of counties and townships. Generally, the county has zoning jurisdiction unless there is an organized township with zoning regulations. If the Public Service Commission has siting jurisdiction, the county or township and the commission have joint jurisdiction with the more stringent regulation applicable to the wind facility.

Once the jurisdiction of the Public Service Commission is engaged under NDCC Chapter 49-22, a utility needs a certificate of site compatibility from the Public Service Commission under Section 49-22-07. The procedure to receive this certificate begins with a letter of intent from the utility to the commission followed by an application for a certificate under Section 49-22-08. The application requires information on the facility, including the environmental impact of the facility, the need for the facility, a comprehensive analysis supporting why the location is best-suited for this facility, mitigative measures for foreseen adverse impacts, and other information. Under Section 49-22-09, the commission must consider these factors when evaluating and designating sites:

1. The effect of the site on public health and welfare, natural resources, and the environment.
2. The effects of new energy conversion technologies and systems designed to minimize adverse environmental effects.
3. The potential for beneficial uses of waste energy from the proposed facility.
4. Adverse direct and indirect environmental effects which cannot be avoided.
5. Alternatives that minimize adverse impact.
6. Irreversible and irretrievable commitments of natural resources.
7. The direct and indirect economic impacts of the proposed facility.
8. Existing plans for other developments in the vicinity of the site.

9. The effect of the proposed site on scenic areas, historic sites and structures, and paleontological and archaeological sites.
10. The effects of the site which are unique because of biological wealth or because of rare or endangered species.
11. Other problems raised by governmental entities.

Under NDCC Section 49-22-05.1, the commission is required to develop criteria to be used in identifying exclusion and avoidance areas and to guide the site evaluation and designation process. Under this section, the commission has developed rules contained in North Dakota Administrative Code (NDAC) Section 69-06-08-01 relating to energy conversion facility siting. Exclusion areas must include a buffer zone of reasonable width to protect the integrity of the area. In addition, exclusion areas include:

1. National parks; memorial parks; historic sites and landmarks; natural landmarks; historic districts; monuments; wilderness areas; wildlife areas; wild, scenic, or recreational rivers; wildlife refuges; and grasslands.
2. State parks; forests; forest management land; historic sites; monuments; historical markers; archaeological sites; grasslands; wild, scenic, or recreational rivers; game refuges; game management areas; management areas; and nature preserves.
3. Political subdivision parks and recreational areas; hardwood draws; and enrolled woodlands.
4. Prime farmland or unique farmland unless the commission finds that the prime farmland and unique farmland that will be removed from use for the life of the facility is of such small acreage as to be a negligible impact on agricultural production.
5. Irrigated land.
6. Areas critical to the life stages of threatened or endangered animals or plant species.
7. Areas where animal or plant species that are unique or rare to the state would be irreversibly damaged.

Avoidance areas are geographical areas that may not be used for siting unless the applicant shows there is no reasonable alternative. Again a buffer zone of reasonable width to protect the integrity of the area must be included. Avoidance areas include:

1. Historical resources not designated as exclusion areas.
2. Areas within city limits for the boundaries of a military installation.
3. Areas within the hundred-year floodplain.
4. Areas that are geologically unstable.
5. Woodlands and wetlands.
6. Areas of recreational significance not designated as exclusion areas.

In addition to exclusion and avoidance areas, the commission must look at the following impacts and the applicant must demonstrate that any significant adverse impact will be kept to an acceptable minimum. These impacts include:

1. The impact on agriculture.
2. The impact on governmental, health care, recreational, transportation, retail, and utility services.
3. The impact on local institutions, noise-sensitive land uses, rural residence and businesses, aquifers, human health and safety, animal health and safety, plant life, temporary and permanent housing, and temporary and permanent skilled and unskilled labor.
4. The cumulative effects of the location of the facility in relation to existing and planned facilities and other industrial development.

For purposes of example, the following information was taken from two recent orders from the Public Service Commission for site compatibility for a wind energy conversion facility. Both orders were issued on August 12, 2009--the PrairieWinds ND 1 project in Ward County and the Rough Rider Wind I project in Dickey County.

For purposes of background, the PrairieWinds project is seventy-seven 1.5 megawatt turbines with a capacity of 115.5 megawatts. The estimated cost of construction is $240 million and the project area encompasses approximately 30,000 acres; however, the direct land use will be approximately 100 acres.

The Rough Rider Wind project is one hundred sixteen 1.5 megawatt turbines with a capacity of 175 megawatts. The estimated cost of construction is $310 million and the project area encompasses 16,100 acres; however, the direct use of land will be approximately 233 acres.

As a general rule, the setback from an occupied residence is 1,400 feet. This distance is set based on acceptable sound and shadow flicker levels. Average noise levels at the residence should not exceed 50 decibels at this range. Fifty decibels is between a refrigerator motor and a microwave or dishwasher running. The setback from a public right of way, existing transmission line, railroad track, and property boundary is approximately 400 feet or 1.1 times the turbine height from the base to the highest point of the rotor blade. Generally, facilities are located away from wetlands and woodlands to avoid effects on wildlife. The setback from United States Fish and Wildlife Service Waterfowl Production Areas is 1,320 feet. The setback for wetlands greater than 50 acres is 500 feet. The setback from United States Air Force missile sites is 5,280 feet.

After notice and a public hearing, the commission may designate a site for the proposed facility. Under NDCC Section 49-22-13, the commission must hold public hearings in the county in which any site is proposed to be located. Under Section 49-22-16, the issuance of a certification of site compatibility is the sole site approval required to be obtained by the utility. However, a certificate of site compatibility does

not supersede or preempt any local land use, zoning, or building rules and a site may not be designated which violates these rules. In addition, utilities subject to Chapter 49-22 must obtain state permits required to construct and operate energy conversion facilities and must follow the rules of any state agency.

2007-08 STUDY

During the 2007-08 interim, the Energy Development and Transmission Committee studied the siting and decommissioning of commercial wind farms. The study included the identification of key issues of public and industry concern; solicitation of public input from local government officials, electric utilities, wind industry, landowners, farm organizations, and other concerned interests; review of laws and policies of other jurisdictions; recommendations concerning laws or policies needed in this state to address wind farm siting and reclamation of wind farm sites; and decommissioning of wind farm sites.

The committee was informed that problems exist whenever a new industry comes into the state and it was argued that the state needs to set standards for wind tower siting, especially as to setbacks. The industry standard is five rotor blade diameters from the property line as the prevailing winds blow and three rotor blade diameters otherwise. Without this standard, first come, first served is the rule and it was argued that this is not fair when two adjacent wind farms begin a project at about the same time.

It was argued that wind should be treated like oil and gas wells--as a shared resource--because the property owner affected by a wind wake has a property interest in the wind. The committee received information on wind resource-based compensation for cooperative development. Under this plan, the landowner hosting the turbine would receive 25 percent of the turbine payment and the remainder would be allocated in proportion to the percentage of wind wake affecting each landowner's property.

The committee received testimony in favor of the state regulation that includes the industry standard for setbacks. The committee was informed that state setbacks would prevent competition among counties for wind projects. In addition, the uniformity would provide for the orderly and consistent development for a new industry. In addition, it would be easier for companies building wind towers.

The committee received testimony against strict setback requirements. A strict setback requirement could prevent a viable wind farm due to an area in which a wind farm is not viable. Because of the prairie geology in this state, there could be a high point ideal for a wind tower within the setback of a low point that would never have a wind tower.

PUBLIC HEALTH IMPACTS

The resolution suggests the study of noise and visual disturbances. One area of concern in the design of wind facilities and by individuals living close to a wind turbine is shadow flicker. A moving object that comes between the observer and a light source can cause a flicker effect. Three conditions must occur at the same time for there to be a shadow flicker. First, the sun must be shining and there must be no cloud cover. Second, the moving object must be between the observer and the sun. Finally, the observer must be close enough to the object to be in its shadow. In the case of wind turbines, another condition is required--the blades have to be facing toward or away from the sun.

For example, because the sun rises in the east and sets in the west, the wind would need to be blowing in the morning or evening, basically directly in line with the sun, on a day with few clouds for there to be a shadow flicker. The observer would need to be a certain distance from the tower to experience the shadow flicker. The shadow flicker would be for a limited duration because the shadow flicker would move toward the tower as the sun rose and away as it set. By examining weather and the sun, a wind developer should be able to minimize the shadow flicker even more by not placing a tower in a poor location in relation to a residence. In addition, other mitigative measures can be taken; for example, placing trees or other obstructions between the windows of the residence and the tower.

On May 22, 2009, the Minnesota Department of Health, Environmental Health Division, issued a report entitled *Public Health Impacts of Wind Turbines.* In briefly addressing shadow flicker, the report stated:

> Modeling conducted by the Minnesota Department of Health suggests that a receptor 300 meters perpendicular to, and in the shadow of the blades of a wind turbine, can be in the flicker shadow of the rotating blade for almost 1 ½ hour a day. At this distance a blade may completely obscure the sun each time it passes between the receptor and the sun. With current wind turbine designs, flicker should not be an issue at distances over 10 rotational diameters (~1000 meters or 1 km (0.6 mi) for most current wind turbines). This distance has been recommended by the Wind Energy Handbook (Burton et al., 2001) as a minimum setback distance in directions that flicker may occur . . . .
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> Unlike low frequency noise, shadow flicker can affect individuals outdoors as well as indoors, and may be noticeable inside any building. Flicker can be eliminated by placement of wind turbines outside of the path of the sun as viewed from areas of concern, or by appropriate setbacks.

In addressing noise, the report stated:

> [The National Research Council of the National Academies (NRC)] notes that different people

have different values and levels of sensitivity. Impacts noted by the NRC that may have the most effect on health include noise and low frequency vibration, and shadow flicker. While noise and vibration are the main focus of this paper, shadow flicker (casting of moving shadows on the ground as wind turbine blades rotate) will also be briefly discussed.

Noise originates from mechanical equipment inside the nacelles of the turbines (gears, generators, etc.) and from interaction of turbine blades with wind. Newer wind turbines generate minimal noise from mechanical equipment. The most problematic wind turbine noise is a broadband "whooshing" sound produced by interaction of turbine blades with the wind. Newer turbines have upwind rotor blades, minimizing low frequency "infrasound" (i.e., air pressure changes at frequencies below 20-100 Hz that are inaudible). However, the NRC notes that during quiet conditions at night, low frequency modulation of higher frequency sounds, such as are produced by turbine blades, is possible. The NRC also notes that effects of low frequency (infrasound) vibration (less than 20 Hz) on humans are not well understood, but have been asserted to disturb some people.

Finally, the NRC concludes that noise produced by wind turbines is generally not a major concern beyond a half mile.

There are three types of noise from a wind turbine. Mechanical noise caused by the generator, gears, etc. In newer wind turbines mechanical noise is a fraction of aerodynamic noise. Aerodynamic noise is caused by wind passing over the blade. Current blade designs minimize the amount of turbulence and noise. If the levels are too high, improper blade angle or alignment of the rotor can be adjusted. The modulation of aerodynamic noise is the major source of complaints. Rhythmic modulation of noise, especially at a low frequency, has been found to be more annoying than a steady noise.

In addressing the potential adverse reaction to sound, the report stated:

Stress and annoyance from noise often do not correlate with loudness. This may suggest, in some circumstances, other factors impact an individual's reaction to noise. A number of reports, cited in Staples (1997), suggest that individuals with an interest in a project and individuals who have some control over an environmental noise are less likely to find a noise annoying or stressful.

Berglund et al. (1996) reviewed reported health effects from low frequency noise. Loud noise from any source can interfere with verbal communication and possibly with the development of language skills. Noise may also impact mental health.

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Noise complaints are usually a reasonable measure of annoyance with low frequency environmental noise. Leventhall (2004) has reviewed noise complaints and offers the following conclusions:

"The problems arose in quiet rural or suburban environments

The noise was often close to inaudibility and heard by a minority of people

The noise was typically audible indoors and not outdoors

The noise was more audible at night than day

The noise had a throb or rumble characteristic

The main complaints came from the 55-70 years age group

The complainants had normal hearing.

Medical examination excluded tinnitus.

These are now recognized as classic descriptors of low frequency noise problems."

These observations are consistent with what we know about the propagation of low intensity, low frequency noise. Some people are more sensitive to low frequency noise. The difference, in dB, between soft (acceptable) and loud (annoying) noise is much less at low frequency (see Figure 4 audible range compression). Furthermore, during the day-time, and especially outdoors, annoying low frequency noise can be masked by high frequency noise.

In addition, low-frequency noise can also be accompanied by shaking, vibration and rattling.

In conclusion, the report stated:

Wind turbines generate a broad spectrum of low-intensity noise. At typical setback distances higher frequencies are attenuated. In addition, walls and windows of homes attenuate high frequencies, but their effect on low frequencies is limited. Low frequency noise is primarily a problem that may affect some people in their homes, especially at night. It is not generally a problem for businesses, public buildings, or for people outdoors.

The most common complaint in various studies of wind turbine effects on people is annoyance or an impact on quality of life. Sleeplessness and headache are the most common health complaints and are highly correlated (but not perfectly correlated) with annoyance complaints. Complaints are more likely when

turbines are visible or when shadow flicker occurs. Most available evidence suggests that reported health effects are related to audible low frequency noise. Complaints appear to rise with increasing outside noise levels above 35 dB(A).

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The Minnesota nighttime standard of 50 dB(A) not to be exceeded more than 50% of the time in a given hour, appears to underweight penetration of low frequency noise into dwellings. Different schemes for evaluating low frequency noise, and/or lower noise standards, have been developed in a number of countries.

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Low frequency noise from a wind turbine is generally not easily perceived beyond ½ mile. However, if a turbine is subject to aerodynamic modulation because of shear caused by terrain (mountains, trees, buildings) or different wind conditions through the rotor plane, turbine noise may be heard at greater distances.

SUGGESTED STUDY APPROACH

The equities that need to be addressed in wind rights allocations are the rights of the property owner with the wind turbine in relation to the rights of a landowner without the turbine but with affected rights, such as the wind resource. In statutorily defining the rights of these parties, wind developers will have more certainty when constructing wind farms and potentially better wind farms will be built without controversy. In addition, the development can be based on the availability of the resource, not property lines, thereby utilizing the resource more fully.

If the committee decides to allocate wind rights, the committee will need to delineate the rights that deserve compensation in relation to a wind turbine and assign weights to those rights. To do this, the committee may desire to receive testimony from persons impacted by a wind tower. The weights assigned will dictate the model of allocation. If the committee determines the only impact worth compensation is on the landowner with the facilities relating to a wind turbine, the first-in-time, first-in-right model is appropriate. If the committee determines that there are other impacts worth compensation, then the unitization model is appropriate. If the unitization model is chosen, then testimony from industry may be useful in developing a system that is able to be easily understood and is not administratively burdensome.

ATTACH:1